vol. I no. 9
June, 1942

SPECIAL ISSUE:

'Shop Training for Victory'

ARTICLES AND PROJECTS FOR WARTIME TRAINING!

School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

Oxyacetylene

WELDING

The Slidefilms on Oxyacetylene Welding

1. An Introduction to Welding
Oxyhydrogen and Oxyacetylene welding.. Pressure gauges and torches..Safety.

2. Setting Up and Lighting the Welding Torch
Use of equipment.. Safety precautions.

3. Welding Flat Ripples
Tools, equipment, and materials needed.

4. Flat Butt Welds
Preparation..Procedures..Inspecting weld..Tests.

5. Fillet Welds—Steel
Tools, equipment, materials, and preparation.

6. Vertical Welds—Steel
Vertical fusion welding, lap welding, fillet welding, cross welding.. Inspecting.

7. Tube Welds—Steel
Specific operations.. Materials and preparation.

8. Cluster Welds
Special tools.. Preparation and materials.. Inspection.

9. Oxyacetylene Cutting
Cleaning and preparing the cut.. Preparing cutting torch..Safety.

10. Welding Stainless Steel
Tools, materials and equipment.. Definition of characteristics.

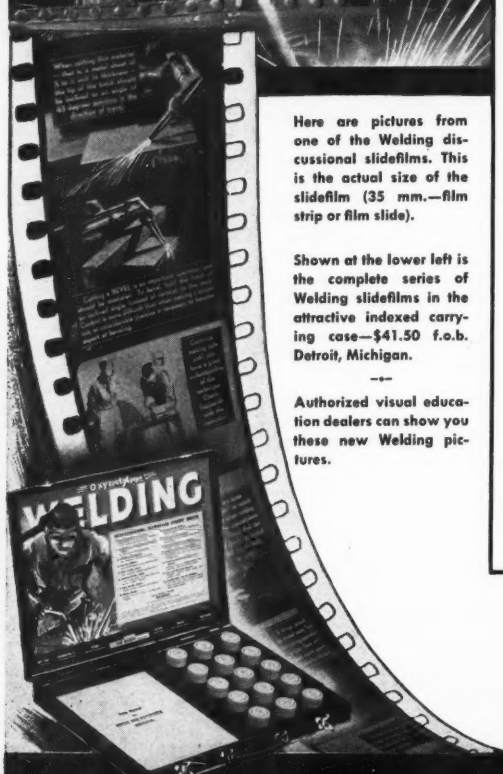
11. Brazing and Silver Soldering
Definitions.. Tools, equipment, and materials.

12. Welding Aluminum Flat Sheets
Characteristics of aluminum.. Uses of flux..Making tack welds, butt weld, lap weld, wandering weld.

13. Welding Aluminum Tubes with Sheets
Review of aluminum welding properties.. Flux.. Preparation.. Fillet weld..Welding flanges.

14. Fuel and Oil Tank Repairs
Preparation.. Cleaning metals.. Safety.. Tack welding.. Testing.

15. Qualification Test for Welders
Test welds: Single V Butt, Tubular Butt, Vertical Fillet, Combination Sheet and Tube, Horizontal Fillet..Checks and Tests.



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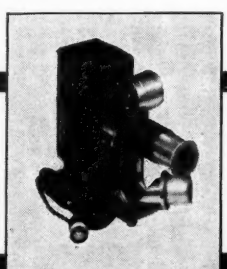

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With this issue, SCHOOL SHOP closes the school year. Our next number will be out in September. If you change your school address, will you **please** let us know as soon as possible so you will not miss your fall issues?

Thanks!

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School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

June, 1942
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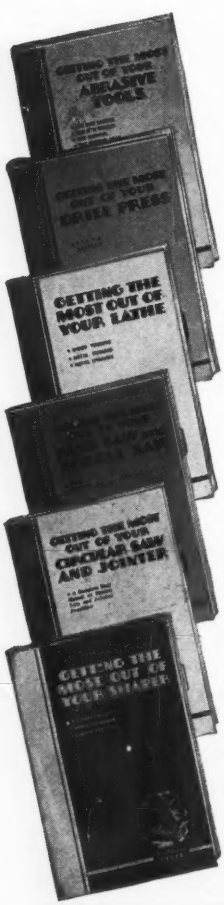
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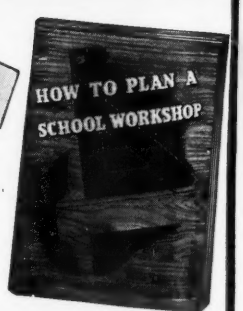

Prepared by vocational instructors from all over the country—the shop layouts and photographs contained in this new book are authentic school shop installations embodying the most ingenious solutions of the problems of space, safety, lighting, convenience and teaching efficiency in both small and large schools. There are actual floor plans and photographs of 30 shops in this attractive 44 page book.

In addition, this new book for the first time makes available important information on the new type of industrial power tools that are being so rapidly adopted for school use. Each tool is listed individually—and instructions for the placing and most efficient use of each tool are given.

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Night view of a Los Angeles welding training center.

Winning the War with Welders

BY *J. Douglas Wilson*

SUPERVISOR, NATIONAL DEFENSE TRAINING PROGRAM, LOS ANGELES, CALIFORNIA, CITY SCHOOLS

with welding taking a place second only to machine shop in training of war workers, the Los Angeles welding program is a mark to shoot at!

IT MUST not be implied from the title that the war will be won only because of welders and their work, but it must be recognized that the war cannot be won without them. It is common knowledge the success of the Allies is only in proportion to the equipment they have available at the right places and at the right time. This equipment, whether it be guns, or tanks, blankets or food or planes, cannot be sent to the war centers unless the United States has ships enough to carry these all-important supplies. Our country will only have sufficient ships if we build them; they cannot be built in sufficient quantities to immediately solve our supply-line problem unless there are trained welders in the shipyards, working day and night, seven days a week, welding keels, bulkheads, bows, and decks; again welding these prefabricated parts into the larger whole until another steel ship slides down the ways.

Webster defines welding as "the consolidation of pieces of metal by fusion"; the process, in simplest terms is one of heating the edges of two pieces of metal plate with an electric arc; then, using an electrode of welding rod, fuse the two pieces together, the joint, by test, being actually stronger than the "parent" metal.

Welding has, in the past few years, come into its own as an important trade. Particularly did its importance jump ahead when new steel ships were designed to be welded instead of riveted. There are, of course, many rivets still used in various parts of a ship; in the main, however, the modern steel ship has few rivets as compared with ships built during the last war. A ten-thousand ton freighter, recently constructed had thirty-five and one-half miles of arc welded joints made by manual operation and seven and one-half miles made by automatic operation!

The training program described below is typical of many such programs in numerous cities throughout the United States that have shipyards in their vicinity or that have industrial factories turning out welded products for our Army, Navy, or aircraft divisions.

Like the majority of cities at the beginning of the National Defense Training Program in July 1940, welding was not a large part of the vocational program offered in the Los Angeles public schools. When the call came to train welders, special training centers had to be constructed and equipped with the necessary welding machines, hand torches, radiographs, helmets, and numerous other supporting hand tools. The Los Angeles Board of Education on recommendation of Dr. Vierling Kersey, Los Angeles City School Superintendent, approved a plan whereby 17,000 square feet of playground at the Banning High School in the city of Wilmington, (a part of the Los Angeles school district) was allocated for use as a welding training center. A 2" surface of black topping (such as is used in road construction) was first laid to make a level and smooth work area. Eighty welding booths were constructed on this surface; wired for power and light; a couple of bungalows were moved in for toolroom and sanitary facilities; a wire fence was erected around the entire set-up; the fence covered with canvas; and the center was ready for the business of training.

During the construction period, teachers were secured by selecting expert welders from the shipbuilding industry; trainees were requisitioned from the California Department of Employment offices (now the U.S. Employment Service). Arrangements were likewise made for the necessary steel and welding-rod training supplies. Local shipyards also helped as equipment was loaned for temporary use while permanent equipment was being secured and scrap steel was donated on a "pound for pound" re-

turn basis. Bids were taken and orders placed by the Los Angeles city school business department for a regular supply of steel and welding rod, which is bought on the tonnage basis.

The training project at the Banning High school got under way during the month of June, 1941. A similar training set-up was also provided at San Pedro; two other Los Angeles high schools that already had modest welding departments were also included in the expansion program.

Each trainee takes four hours of training per day; this arrangement provides six training periods during a 24 hour day. The four training centers have a total of 152 welding training stations. With these machines it is therefore possible to enroll a maximum of 912 different trainees each 24-hour day. Incidentally, there will be 40 additional machines in use this June, as another training center is now being developed to serve a tank factory.

Well selected trainees, who have already had some welding experience, or similar mechanical work, can be trained and are acceptable for employment after a total of 180 to 300 hours of training. The range in the number of hours of training is based on the individual differences of each man and because shipyards, due to the great need for welders, employ men who have not completed their training and been qualified as three-position welders. A three-position welder is an expert craftsman who is able to weld in three positions, namely flat, vertical, and overhead.

To determine the number of positions in which a man is qualified to weld, all welders, whether trainees or trade experienced, are required to pass a comprehensive welding test, the regulations of which are set by the Maritime Commission or the Navy.

After the training centers were operating on a full-time 24-hour basis it became apparent to the shipbuilding industry, the Maritime Commission, the Employment Service, and the public schools, that a welding test laboratory should be established in the vicinity of the shipyards and various public-school training centers which are located in nearby cities, such as Long Beach, Santa Monica, Redondo Beach, as well as San Pedro and Wilmington. There are also other public-school programs operating further inland, such as at Glendale and Pasadena.

At the request of the shipbuilding advisory committee, the Los Angeles schools were asked to plan, design, construct, and administer this laboratory. The preparation procedures followed at the Banning School were again duplicated: starting from scratch a building was rented; wired for power and light; 30 booths constructed and welding equipment purchased. While this was being done, testing procedures were developed and the laboratory personnel hired. The testing job is a tremendous one when it is realized that *no* welder can be employed unless certified by a responsible laboratory. With 152 training stations in the Los Angeles program and over 200 more in nearby cities it will be seen that the laboratory had to be organized to do a large testing business. Expanding shipyards were employing any and all available welders many of whom also had to be tested. No charge is made for the test as the federal government reimburses the Los Angeles city schools for the costs of operating the laboratory.

The laboratory has a capacity of 200 tests per day of 24 hours. From its inception until the first of May, 19,426 tests have been given. The percentage passing the "lab" the first time as three position welders is not large; the number of welders who fail to pass at least one position is also relatively small. As a man is allowed to take additional tests provided he has taken at least 30 hours of additional training in the phase of welding on which he failed, it is possible for him to qualify in the other one or two positions.

The test as required by the Maritime Commission is in four parts: appearance (or observation), nick, bend, and tensile. From 2½ to 4 hours are required to take a complete test. Each trainee is required to weld three sets of plates (coupons), in flat, vertical, and overhead position, respectively. Each welded coupon is then cut into three parts and the nine coupons are tested, using the nick, bend, and tensile procedure.

Trainees from the public schools are first sent to the Department of Employment and from there referred to the shipyard needing welders; the yard then assigns the men to the laboratory to take the test. Experienced welders are sent direct to the test station by their union. In all cases, no one is accepted for a test unless properly identified.

Los Angeles City Schools National Defense Training Program

WELDING TRAINING PROGRAM

Unit A. Basic preparation and safety training.
Safety operations:
1. Proper clothing.
2. Protection of eyes and body.
3. Proper and safe equipment.
4. How to handle hot iron.

Care and use of machine and equipment (operations):
1. How to start and stop machines.
2. How to operate and adjust machines.

Unit B. Burning—hand and radiograph.
Operations:
1. Setting up equipment.
2. Regulating and adjusting the torch.
3. Operating the torch.
4. Gaining knowledge of weld steel.

Unit C. Fundamental procedures of arc-welding. (applies to units D, E, F)
Operations:
1. Correct size and type of rod.
2. Setting of polarity.
3. Proper current.
4. Angle of rod.
5. Striking the arc.
6. Arc length.
7. Speed of travel.
8. Starting and stopping the bead.

STRINGER BEAD

Unit D. Flat welding.
Job exercises:
1. Independent stringer bead.
2. Lapped stringer bead.
3. Fillet stringer bead.
4. Butt stringer bead.

Unit E. Vertical welding.
Job exercises: same as for flat welding.

Unit F. Overhead welding.
Job exercises: same as for flat welding.

Unit G. Appearance test projects:
1. To determine ability in flat and vertical.
2. To determine ability in vertical and overhead.
3. To determine ability in flat, vertical, and overhead.

SPECIAL WEAVE BEAD WELDING

Unit H. Flat welding.
Job exercises:
1. Independent weave bead.
2. Lapped weave bead.
3. Fillet weave bead.
4. Butt weave bead.

Unit I. Vertical welding.
Job exercises: same as for flat welding.

Unit J. Overhead welding.
Job exercises: same as for flat welding.

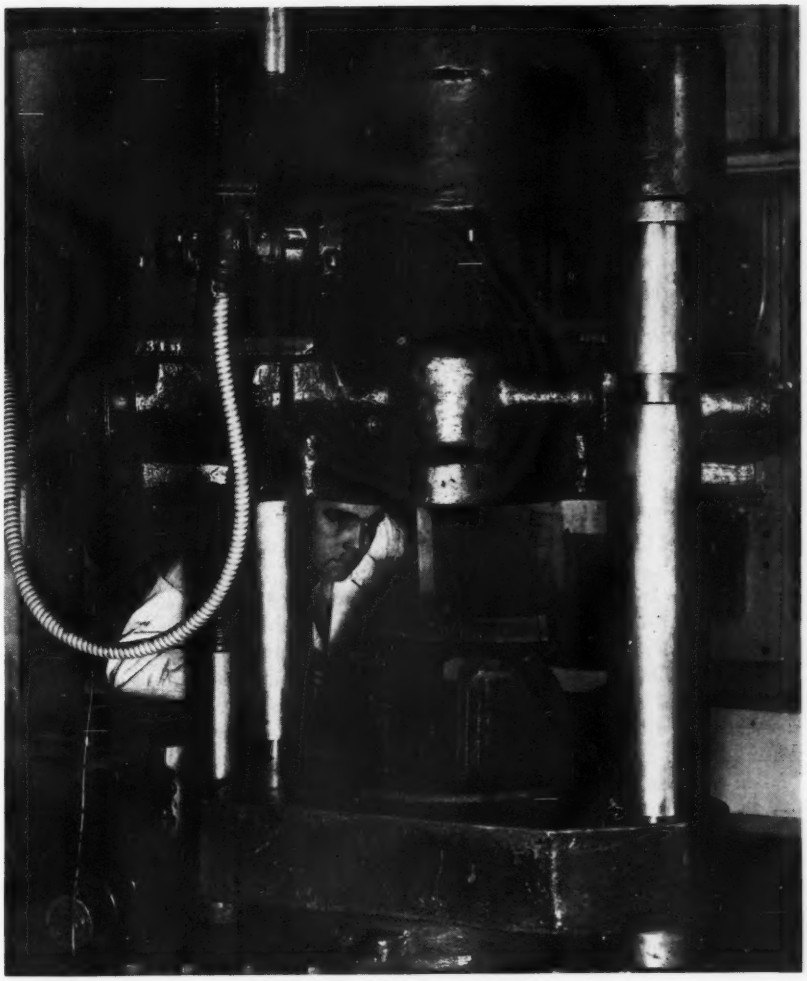
Unit K. Appearance test projects: same as for unit G.

Trainees are assigned to the test shop by number so that the entire testing procedure becomes distinctly impersonal. If a man fails on any one of the three positions, his test record is sent back to his school and a report card checked, indicating the causes of failure. This card helps individual instructors to check up on their teaching procedures and make corresponding adjustments if necessary. Successful test reports are sent to the referring shipyards who in turn notify the men to report for work.

The percentage of successful testees is in proportion to previous experience, training, and the reaction of each man during the test. Some men become quite nervous, perform badly, and therefore do not pass all positions. They take additional training and then return for a "retake." The number who pass two positions (thereby becoming employable) is, of course, much higher than those who pass all positions. More public-school trainees are now passing than at first, due to improved training methods based on a study of failures. Welders recommended for the test by the shipyards before their training is fully completed is another cause for some of the laboratory test failures.

Instructors for the various welding classes are selected from expert welders who desire to participate in wartime activities through the teaching program. Each man must, however, be "credentialed" through the California State Department of Education Commissions of Credentials, the same as any regular teacher. The state credential is issued on the basis of actual trade experience. Mr. John C. Beswick, veteran California State Director of Vocational Education, insists that the standards for wartime instructors be the same as for the Smith-Hughes instructors. He wants to be sure each prospective candidate for a vocational credential knows his trade, which is a basic factor in securing good trade teaching. The new wartime teacher must also take several teacher-training courses as soon as he is on a teaching assignment. To determine the trade or craft ability of the welding teacher, each man is required to pass the laboratory test before his state credential papers are released.

The results of any training experience are in proportion to the organization and content of the training program, assuming, of course, the teacher is well qualified. Local supervisors of wartime training programs are responsible for all training courses and must be sure that the teaching content of several classes in the same occupation is properly coordinated. The basic program being followed by all welding instructors in the Los Angeles city schools is outlined below. It was developed by a group of "leaderman" welding instructors, each of whom has had over 22 years of actual welding experience. While it is not possible, as indicated above, to hold every student for the entire period of training so that he becomes proficient in all of the units of work listed, the course given is comprehensive enough to cover all types of work necessary to train a three-position welder.



Nick-break test of welded coupon.

The success of any vocational program is usually measured by the number of students who use their training through actually securing a job. Accurate placement figures are often hard to obtain; students will leave a class and get a job without reporting to their instructor. Probably the best measuring stick for the welding training programs through the Los Angeles metropolitan area is to check the employment rolls of the various shipyards in this same area. The evidence here is convincing; welding personnel is constantly increasing and—best of all—ships are sliding down the ways in increasing numbers, with shorter elapsed time between each launching.

That welders are definitely helping to win the war is evident in numerous parts of the United States. The Los Angeles program is only a "sample" of public-school welding training programs in other stragetically located areas. Ships and tanks are constantly increasing in quantity and the production processes are definitely picking up speed.

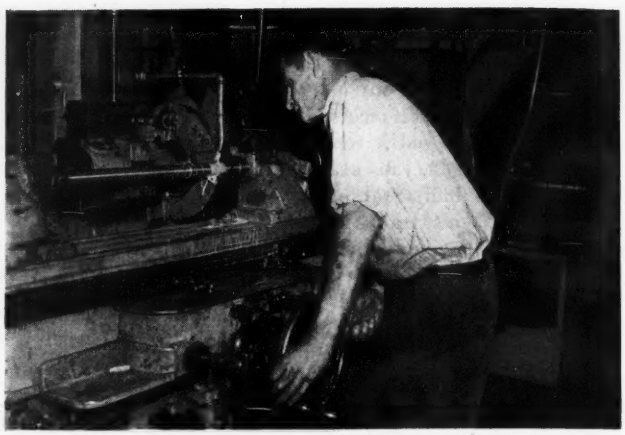
Certainly the program of building airplanes, tanks, battleships and merchant ships to strengthen our national defense has disclosed the importance of skilled workers in the industrial process. Never before have we had such an object lesson in the value to a nation of a strong program of vocational education and never before has practical training been given such unanimous endorsement by the American people.

Simplified Procedure for

BUDGET-INVENTORY-TOOLROOM

BY *G. A. Becker,* MACHINE SHOP INSTRUCTOR
WEST TECHNICAL HIGH SCHOOL, CLEVELAND

efficient control of budget, inventory, and toolroom procedure eliminates confusion and saves time for administrators, teachers, and pupils.



BUDGETS, inventories, and toolroom efficiency, like pupils' grades, are very often disturbing factors between administrators and teachers; between shop teachers using the same shop at different periods; and between students and teachers. Here is a way to simplify and organize an effective control of all three units to the benefit of all concerned.

As an example, a general metal shop with its numerous activities has been chosen for the explanation of the simplified control of budgets, inventories, and toolrooms. Activities in the general metal shop are:

1. Gas Welding
2. Electric Welding
3. Sheet-Metal Work
4. Spinning
5. Forging
6. Lathe Operations
7. General Machine Shop Bench Work
8. General Shop Maintenance Work

Each requires special tools and means for separate budgets.

Budget

It is common practice to ask each shop instructor to hand in a yearly budget for the purchase of equipment, small tools, supplies, and materials. To estimate the quantity needed according to anticipated enrolment and number of classes is fairly easy where a fixed and approved curriculum exists. However, it is rather annoying to shop teachers to be informed overnight that this or that has to be stricken off or curtailed for some reason or that class enrolment has suddenly increased. The administration depends unquestionably on the resourcefulness of the teacher to change to different projects or systems at will. If the curtailments are within reasonable limits, the change of projects do not affect the curriclum. But these cuts affect the curriculum and classroom organization more often than not and, as a consequence, teaching may become mere entertainment—just a matter of providing everybody with a job. This could be prevented if the extent of curtailment were to be made known to the teacher at the earliest possible time.

Since budget difficulties seem to be universal with large and small systems alike subject to them, a plan is submitted that may help to remedy much unpleasantness. Printed departmental forms could be distributed. (See Form I.) The "On Hand" column is the actual shop inventory at the close of the semester or at a set date during the term. Following is the budget request for the shop, stipulating whether the tools, materials, etc., are for replacement or addition. This information is handed to the proper authority, who should adjust his yearly account or allotment according to his information of curriculum changes, larger enrolment, or class shrinkage, and total school or department budget allowance. It provides the facilities for a more even distribution, reviews and presents a shop inventory of the department property without going through previous and separate records.

This revised budget sheet or a duplicate returned to the shop instructor gives him a chance to plan any necessary project changes ahead of schedule and provides him with a means of checking on any withdrawal from his storeroom or centralized stockroom account. If the last column on the budget sheet is divided into ten spaces, a monthly withdrawal is possible since it is advisable that individual shops should not be overstocked at any time. In any case the teacher is able to stay within his allowance, particularly if the storeroom or centralized stockroom clerk is provided with the triplicate of the revised budget sheet. Such a plan is without doubt a time-saver, as many systems require the head of the department or the super-

Form I

WEST TECHNICAL HIGH SCHOOL

DEPT. INVENTORY & BUDGET SHEET FOR YEAR ——

DEPT.—— **SHOP——** **SHEET——**

Tools or material and Description (small tools)	On Hand	Requested for		Year's Alot.	Quantity and Date of Withdrawal from stock
		Repl.	Add.		
hammer (ball peen) 1½ lb.	10	2	2	2	
" (machinist) 1½ lb.	3	0	1	0	
" (forging) 3 lb.	2	0	1	0	

Form II **WEST TECHNICAL HIGH SCHOOL**

Flexible Inventory & Locating Sheet for——

Dept. —— **Shop——** **Sheet——**

Work Symb.	Name of Article	On Hand	Needed	Location		Wareh. Cat. No.	Unit Cost
				Place	Shelf		
Bt	saw (hacksaw frame)	6	8	VIII		1278	
"	" (" blades 10/18)	80	288	IX	2	149	
"	screwdriver 3"	6	4	XI	2	2977	

visor to sign requisitions before an instructor is permitted to draw any supplies. It also prevents "sponging" on the budget of someone else.

It is recommended that if a printed or typed department form is used the articles be grouped and arranged alphabetically within each group, for example: Group 1—Small Tools; Group 2—Materials; Group 3—Miscellaneous Supplies for Shop Maintenance.

Inventory and Guide

1. *Permanent Inventory.*—Machine tools and equipment fixed permanently to the floors or walls of the building not subject to loss, exchange, or quick replacement, are listed separately, but alphabetically arranged, stating all necessary data, such as h.p., amp., volts, rpm., serial no., make and type of electric motor or machine. As this inventory changes less frequently it is separated and called permanent inventory.

2. *Flexible Inventory.*—Small and portable machine tools, stock, supplies, etc., undergoing a quantity change during a term or year, make up the flexible inventory. The flexible inventory sheet, usually referred to as the inventory sheet, provides all information required. (See Form II.) This inventory is made out in conjunction with the toolroom arrangement. A toolroom floor plan (See Diagram I.) will be of great help. The identification of stock material, location of tools or equipment should be stated in the column provided. Thus if cabinets, racks, mounting boards, etc., are numbered in Roman numerals, shelves numbered in Arabic, and sections of shelves marked alphabetically, then a tool is quickly located. For example, III—2—A represents cabinet three, shelf two, section A.

A column has been included to indicate the work for which the tool is used. The code is: B—Bench work; A—Machine work; S—Sheet-metal work; F—Forging; W—Welding; M—Miscellaneous for shop maintenance. One has gone so far as to use symbols such as: Bm—Bench machines and major equipment; Bt—Bench tools; Bs—Bench supplies for projects; and Bst—Bench stock for projects.

Toolroom Organization

The purpose of the toolroom is to store all small and portable machine tools and other shop teaching devices. Tools should be issued only against a certified tool-check. Each student receives his classroom tool-checks for which he is responsible during the term. It is necessary, therefore, to provide a hook or nail for every tool in the toolroom at the place the tool belongs. A tool-check laid down by the clerk in any convenient place is too often taken for another tool issued, especially during the rush at the beginning and the end of the period. Then trouble begins.

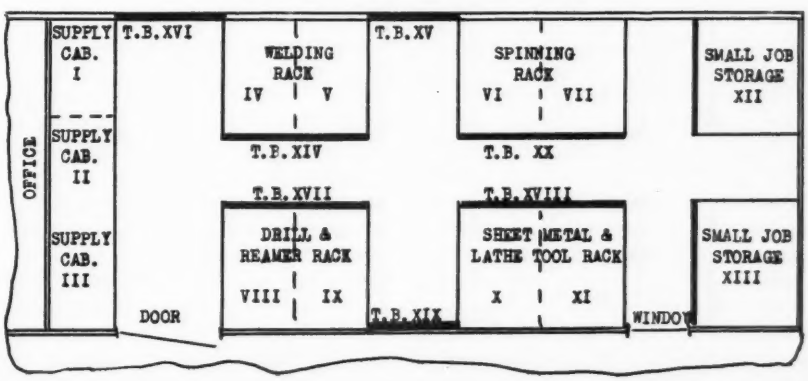
Duplicate tools are not to be staggered, but individually placed or mounted for quick recognition of their presence or absence. With tool-boards a painted outline of the tool on the board may be helpful. Arrange the tools according to the work for which they may be used. All tools for sheet-metal work should be together, as well as all forging tools or all machine-shop bench tools, etc.; e.g., for a general metal-shop toolroom lay-out (see toolroom floor plan), a mounting-board, XVIII, was set aside for sheet-metal tools. It makes it that much easier for the clerk to issue them and to look after them. It also cuts the teacher's time in accounting for their presence at the end of the class period.

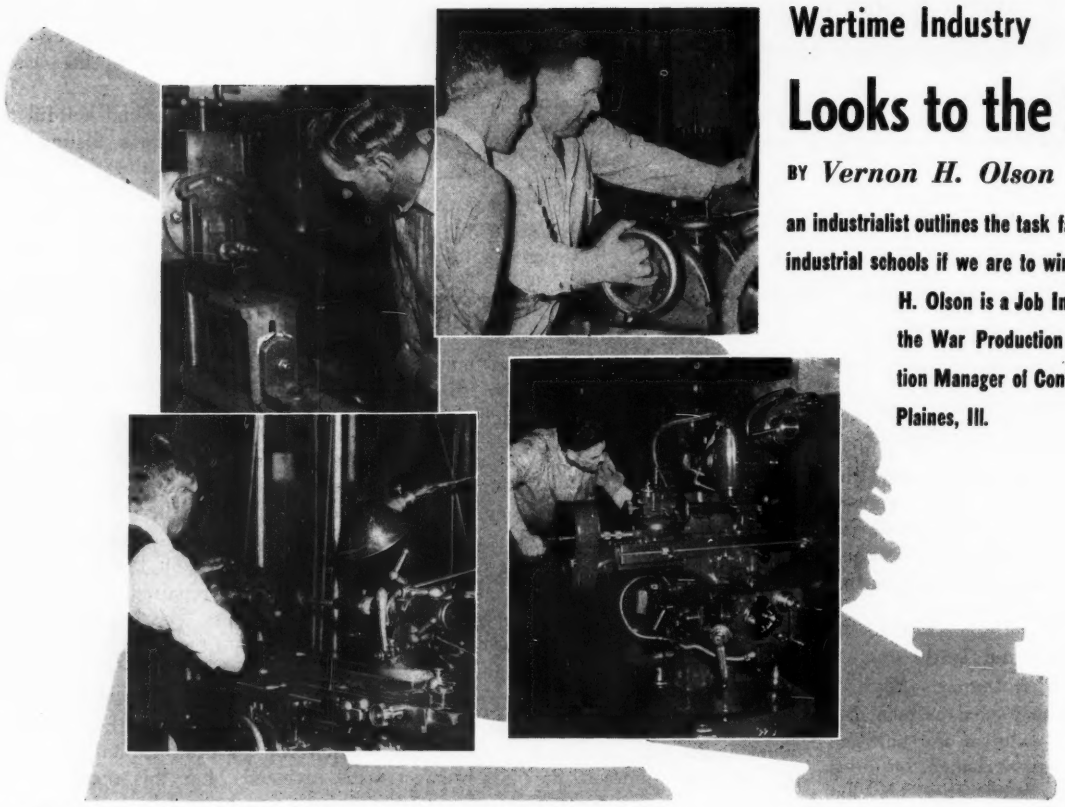
The shop teacher will find helpful a small card index, or book, listing in alphabetical order all the tools and materials in the stockroom, including location of tool in toolroom or storage as well as the quantity. This will assist the toolroom clerk or a substitute teacher in finding tools in the toolroom without the instructor's help. This index is also a good teaching device for properly naming each tool and stating its purpose and use.

Damaged or broken tools are not to be replaced in their rack, but are to be brought at once to the attention of the teacher in charge of the classroom for immediate repair. Tool-checks therefore are not to be taken off the hook until the tool has been repaired or replaced. This also prevents "passing the buck" from one student to another or from one instructor's class to another's class.

Tools are the life of any shop. They are expensive goods to be kept in circulation for no dead capital ever returns dividends. For this reason it is important that no tool be locked up or tucked away by anyone (even though marked "special"). No student or teacher should ever be deprived of a tool to which he is entitled. But often one finds only the most common tools displayed and the rest under lock and key! One cannot conceive that administrators are ordering or are in favor of such a practice. Orderly arrangements of tools and storage facilities are time-savers—a very important factor when one considers that the total actual practicing time of a boy per term, at two periods a day, five days a week, is equal to but 56 hours of employment in industry. It is therefore of great importance that the classroom and toolroom organization function well.

Note: I to XI—matching steel shelves or cabinets. T.B.—Tool display board (ends of shelves are covered from top to bottom with wood for tool mountings).





Wartime Industry

Looks to the Schools

BY *Vernon H. Olson*

an industrialist outlines the task faced by the nation's industrial schools if we are to win the war. Vernon H. Olson is a Job Instructor Trainer for the War Production Board and Production Manager of Contour Saws. Inc., Des Plaines, Ill.

WE WILL agree that education, no less than soldiers and workmen—no less than industry and commerce—must play a part if we are to win this war. And win it we must.

Industry must pay tribute to the industrial teachers representing those schools that have put on defense training programs. Many courses are operating 24 hours a day, and all told there are more than a million students who are taking defense training. This indicates that industrial teachers are fully aware of their obligation and are doing their utmost in this emergency.

We recognize that the depression prevented industry from continuing apprentice training. The depression depleted the rolls of our training schools and fear of excessive taxes prevented high schools from adding industrial training courses.

As a Job Instructor Trainer for the War Production Board, I am going into plants and meeting the foremen and discussing with them the problems that they have with the unskilled and the semi-skilled workers. Through these conversations and training courses I clearly see a lack in the training these workers have received in schools or in their past training in other industry. The J. I. T. axiom "The learner hasn't learned if the trainer hasn't trained" is a truth which challenges all of us as teachers.

The job of industry is to quickly prepare workers for war production, and industrial teachers likewise must develop a streamlined training for war workers. These workers are needed now, for as Donald Nelson said, the machine tool this year may prevent our defeat next year. We must train workers quickly, correctly, and conscientiously.

This streamlined training precludes long expositions on theory or the reading of involved textbooks on the part of the student. Teachers must summarize the field of knowledge and the basic educational points so that courses may be inaugurated overnight. We must institute the "learn by doing" method.

The War Production Board through the Job Instructor Training courses trains foremen and supervisors so that in elementary operations the worker can be trained in approximately 15 minutes. The foreman uses the following four steps: (*a*) He finds out the background of the worker. (*b*) He demonstrates to the worker the job he wants done. (*c*) The worker performs the operation under the foreman's supervision. *(d)* The foreman follows up the training to be sure that the learner knows his job. These four steps are the "learn by doing" method.

Inasmuch as this is the machine age, it follows that this is a machine war. It is natural then that teachers will train youth in the terms associated with machinery. Students should be taught how to use a micrometer, calipers, and gauges of all descriptions.

Schools this spring are facing a different type of emigration of students than in previous years. This is particularly true of boys 17 and 18 years of age. Not so many of them will be returning to Scout camps or enjoying a summer of pleasure. This year they will go into industry at least for the summer, and many of them will not return to school next fall. Some of them will be drafted and others will enlist in the armed forces. Many who do not go into industry will take over the jobs in civil life that have been left by their older brothers who have gone into war production.

With this picture in mind, industrial teachers have a responsibility right now. We can't wait until next fall for a streamlined course to be put into action. The industrial teacher must survey his courses so that the day students as well as the defense classes at night will participate in this streamlined training.

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Atlas

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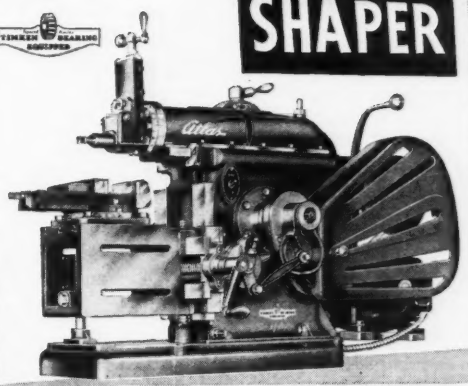

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As adults we must forget the past—the odium that repels those youngsters who would seek their future in the industrial world. Academic courses are entirely in order, but right now industrial courses are more likely to contribute to the knowledge that is likely to save our democracy. It isn't going to be particularly helpful for an English student to quote Shakespeare or Omar Khayyam when he meets a Jap face to face. His skill in operating a machine gun or tank is going to be much more valuable.

It takes a year to train a man to operate a tank. To keep one airplane flying eight men must be trained to service and repair it. A battleship cannot be put to sea without electricians, carpenters, cooks, pharmacists, and radio operators, and men trained in 40 other vocations.

These enumerated points are just one side of the picture. The war effort today involves one man at the front, seven in ordnance and in the machine shop behind the front, and eleven men in industry to keep the lathes humming.

In 1942 our war work will increase so that we will jump from 5,000,000 to 18,000,000 workers. In 1943 instead of 18,000,000 there will be 25,000,000 in war industry.

In the same ratio our civil life pursuits will drop from 44,000,000 in 1941 to 23,000,000 in 1943. The auto mechanic, the bond salesman, the lathe hand in the refrigerator plant largely will have moved into war industry.

Our men in uniform will climb from 2,000,000 in 1941 to 5,000,000 in 1942 and perhaps to 10,000,000 in 1943.

Our working force in the nation will increase from 55,000,000 to 59,000,000 by 1943. Youths graduating from high school will be a part of this figure. Women likewise will contribute to the war effort.

I do not pretend to evaluate our present educational system nor the place of the classics and the general arts. I see the picture as we face the future. For the time being our schools may have to change their emphasis from the general course to that of an industrial nature. What will happen after the war is another matter. Our schools must graduate students whose ideals are sufficiently many-sided, not only to insure them places in our social scale but also to fit them into our industrial world. You perhaps are familiar with the five objectives pertaining to skill and knowledge. These must largely become our objective as we face the immense task before us: (1) To develop in each student an active interest in industrial life and in the methods of production; (2) To develop in each student the ability to select, care for, and use properly the things he buys and uses; (3) To develop in each pupil a knowledge and understanding of mechanical drawing, the interpretation of the conventions used in drawing and work designs, and the ability to express his ideas by means of a drawing; (4) To develop in each student the appreciation of good workmanship and good design; (5) To develop in each pupil elementary skills in the use of more common tools and machines and the knowledge of the methods of procedure in tasks frequently encountered by the average man, together with the knowledge of working qualities and characteristics of some of our most used materials. These are the objectives of industrial education.

We will agree that education, no less than soldiers and workmen—no less than industry and commerce—must play a part if we are to win this war. The picture I have shown you throws part of the responsibility of winning the war directly on the industrial teacher.

DO YOU *Use* YOUR *Priority Ratings!*

ARE you taking full advantage of your priority rights as a shop teacher in the purchase of new and replacement equipment and operating supplies? All shop teachers have been granted preference ratings and should avail themselves of them. Teachers of war workers have been given especially high ratings, and they owe it to their schools and to the nation's war effort to use them in training the millions of workers needed to win the war.

There is nothing complicated about applying for and using priority preference ratings. For purchase of maintenance parts, small tools, and operating supplies, preference rating order P-100 permits the maintenance of inventories of these items in your shop. For new equipment and shop expansions under the program of vocational training of war workers, forms PD-1A and PD-200 are available to teachers in applying for the necessary preference rating.

The priority and allocation system is the only means whereby the War Production Board can assure that machine tools and other equipment are used to the best advantage in prosecuting the war. The WPG has granted vocational teachers and schools preference ratings not only for their convenience but so that the war may be won in the shortest possible time! Your state directory of vocational education can give you complete details on the application of priority preference ratings. Get in touch with him immediately!

WHAT'S DOING IN THE FIELD

news

OF INDUSTRIAL EDUCATION

A MIMEOGRAPHED list of visual aids for vocational training of war workers has just been issued by the U. S. Office of Education. To be supplemented from time to time as new visual material becomes available, this 44-page list includes films, slidefilms, and charts, with data as to price, length, and source. The list may be had by writing L. S. Hawkins, Director of Vocational Training for War Workers, U. S. Office of Education, Washington, D.C.

APRIL of this year saw Volume I, Number 1, of *The Industrial Arts Teacher*, official bulletin of the American Industrial Arts Association. Publication is expected to number three or four times during 1942. Among items of discussion in the first issue are the San Francisco convention, industrial arts and the war program, and priorities.

SUMMER conference of the Pennsylvania Vocational Association will be held at Eagles Mere, June 25 to 27. Headquarters are to be the Forest and Lakeside Inns.

PUBLICATION of a "Job Training for Victory" chart is announced by the U. S. Office of Education. The chart is an index to programs offered by federal agencies to train men and women for work in war industries, governmental agencies, and the armed services. The chart, a revision of the former "Defense Job Training" chart, contains information on persons eligible for training, length of courses, costs, if any, approximate wages after training, where training is given, and where persons should apply. Copies are available from the Superintendent of Documents, Washington, D.C., at five cents each, or $2.00 per hundred.

FACED with a shortage of industrial education teachers in the Detroit schools because of the war, Wayne University, Detroit, has stepped up its industrial education program in two ways. First, it is taking in for short-term intensive training as substitute teachers men who have been employed previously in occupations other than teaching. Each trainee receives intensive training to fit him for the specific type of teaching which he will do, since he will not be transferred to other subject courses. Second, teachers in the Detroit schools may, on application, receive short-term training to fit them for teaching in the vocational education department. On completion of this training, these teachers are transferred to vacancies in this department for the duration.

PRODUCTION of 33 motion pictures to speed training of workers for war industries has been completed and 15 others are now in advanced stages of preparation, the U. S. Office of Education announces. In the 16-mm. films, ranging in length from 275 feet to over a thousand, expert craftsmen show trainees step-by-step procedures in the specific jobs for which they are preparing. Latest films produced are on shipbuilding training; others completed to date deal with machine shop; and a series is in production on bench work.

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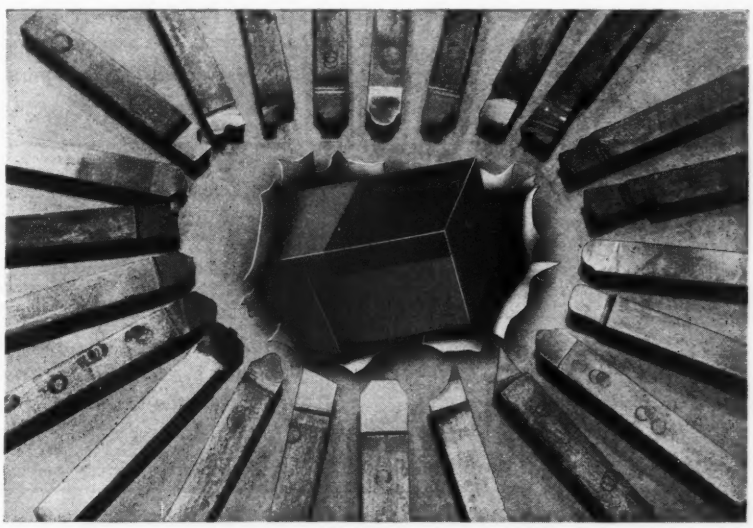

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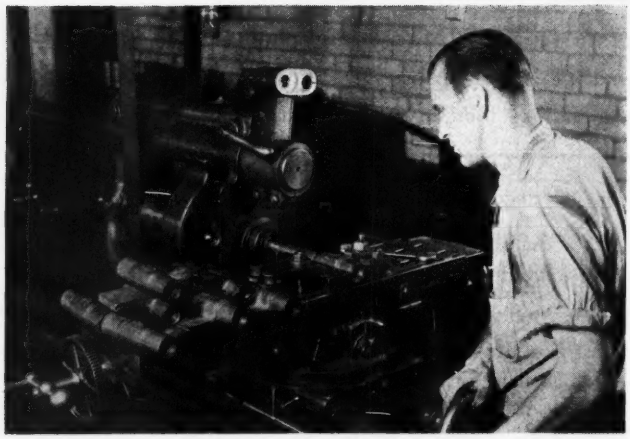
Teaching Hints

BY *M. Norcross Stratton,* ASSISTANT DIRECTOR

VOCATIONAL DIVISION, MASSACHUSETTS DEPARTMENT OF EDUCATION



If you have been teaching long, the suggestions made in this article will be part of your daily teaching practice. Written primarily for vocational training teachers recently drawn from industry, this article points out the many fine points of effective teaching which tend to get lost in the shuffle of today's high-pressure training of war workers.

YOUR pupils have come to you because they want to learn from you about your trade. They are interested, and you must keep them interested by teaching them something they didn't know before. Each pupil should leave each day with some knowledge, some degree of skill, some ability, some idea, he did not have when he came to the session.

Your pupils come with varying degrees of ability, experience, knowledge, background, skills, desires, and aptitudes. You must "size up" your learners and adapt your instruction to their needs and capabilities. You should discover what each one knows or can do, and build upon his previous experience and skill. You should encourage each pupil to progress as rapidly as his abilities permit.

Remember the difficulty of grasping several new ideas at once. Trying to teach too much at one stroke is like trying to pour a gallon of water in a quart jar—when the jar is full, the rest of the water goes to waste. When the pupil has gotten all he can grasp, any additional instructional effort at that time is a waste of effort on your part and of time on his part.

Remember, too, that a learner is generally embarrassed and self-conscious, especially in the presence of one superior to him in the skill he is learning. Do not "bawl out" or humiliate a learner before his associates, but rather praise his progress.

Teaching:

Preparation.—First stage of preparation is to prepare yourself to teach the lesson. All tools, equipment, blueprints, and supplies must be prepared before the class arrives. An assignment must be ready for each pupil. Assignment sheets and pupil-progress record charts should be at hand. And most important, the lesson material must be thoroughly in mind.

Second step in preparation is that of preparing the pupil to receive instruction. At the start of the course, there is little, if anything, in common between teacher and student. A "tuning in" of the teacher's and student's minds must be accomplished by attracting the pupil's attention, arousing his curiosity, maintaining his interest, and creating in him the desire to learn the new idea. Put these words in a column and you have the "acid test" for a good preparation step:

A—attention.
C—curiosity.
I—interest.
D—desire.

Presentation.—This is the point of departure from what the student knows to what he is to learn. Your teaching analysis will show you what the student has to learn, and you should now proceed to get this information or training across to him as effectively as possible.

Seeing the task done is one of the most effective ways of presentation—hence the popularity of the demonstration. But the demonstration must be thoroughly thought through before being performed. Demonstrations should be done slowly, where all pupils can see them, and should be accompanied by many questions from both teacher and student.

In any method of presentation, the teacher should question and check his pupils after presenting each teaching point. In this way you can tell if the class is grasping the demonstration or lesson; and you can go slower, or repeat, or explain an obscure but important point.

Application.—Now the student takes over and tries to do what you have previously done for him. This is the step where he really learns—where he has a chance to use information which he has heretofore merely absorbed. In this step he acquires manipulative skills. The student should be allowed mainly to follow his own path, with assistance from the instructor to see that proper work and safety habits and procedures are followed. Do not embarrass a pupil by standing behind him and observing his beginning efforts too minutely. Do not be quick to cry "Stop" and criticize his work, but ask questions that will lead the pupil to discover his error.

The check-up.—This is the final step of the lesson. Here the teacher discovers if his students can do the work of the lesson with no further instruction or help from him. The teacher does not help the pupil but checks him for accuracy, proper operating technics, carefulness, and good work habits. If the student passes inspection, he should go on to the next unit of work.

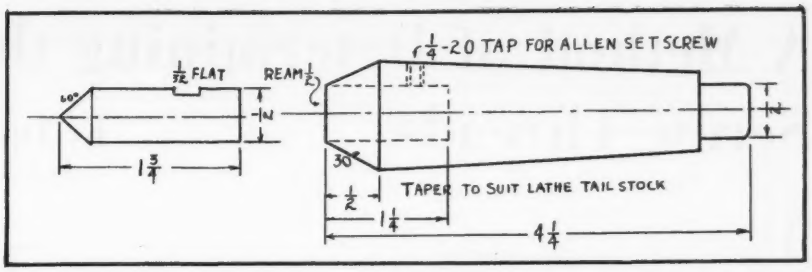
"Do's and Don't's":

1. Keep to the subject. Resist the efforts of some pupils to cause you to digress.
2. *Repetitio mater studiorum*—"repetition is the mother of learning." Repeated experience following instructions develops skill and speed.
3. Never send a man from your shop to a job who will blunder, do substandard work, or cause accidents.
4. Teach safety—in every lesson. Better, teach the *safe* way as the *only* way to do a job.
5. Talk as little as possible. Get across your message in the fewest words you can, and then stop, however great the temptation to expand and amplify.
6. Do not overlook training in the minor points of a skill that are nearly automatic in your performance of them.
7. Be sure your students are familiar with and know how to use related information, names of tools, etc.
8. Don't try to cover a bad teaching job by blaming it on a bunch of "dumb" learners. Your men *have* to succeed in their job and "deliver the goods."

Lathe Tail-Stock Center

By **Harry Freidin**

Not only is this a useful shop item, but it also is excellent for teaching taper turning, heat treating, fitting, reaming, thread cutting, and simple turning. The author is instructor in Machine Shop Practice, Samuel Gompers Vocational High School, New York City.



THIS project is good practice for machine shop, and eliminates the replacement and grinding of tail-stock centers, thereby saving steel and time.

Tail-stock centers stand a lot of abuse in the school and shop, and very often have to be discarded when they get too short for grinding, causing a waste of valuable tool steel. To overcome this, I submit the following drawing and explanation.

Make a regular tail-stock center from cold rolled steel, drill and ream for ½" drill rod, 1¼" deep. Tap ¼ x 20 for Allen set screw.

Turn 60° center on drill rod ½" diameter by 1¾" long, file flat for set screw, harden and temper, and set into tail-stock center.

If drill rod center gets burnt or worn out, all that is necessary is to replace with another piece of drill rod, leaving cold rolled center intact.

These drill rod centers can be made up in dozen lots and kept in stock.

Keeping Track of Patterns

By **John L. Feirer**

WESTERN MICHIGAN COLLEGE OF EDUCATION, KALAMAZOO

MOST metal-shop teachers have at sometime or other had difficulty in keeping track of the many patterns that are used in the shop. Frequently flat patterns are lost or are used by mistake in making a project. These difficulties can be easily avoided by doing two things to the patterns or templates. First, a metal handle should be attached and then the pattern should be painted some bright color. The handle can be either soldered or riveted in place and it will serve both to identify the pattern and as an aid in holding it when transferring the design. If these two precautions are taken there is little danger of misplacing or losing important patterns.

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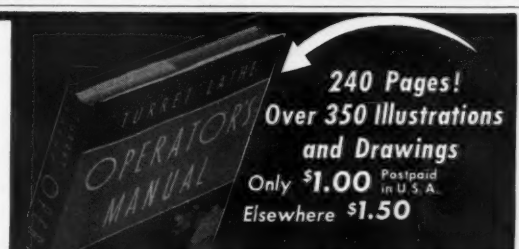

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A Method of Determining the Feed to Cut Screw Threads

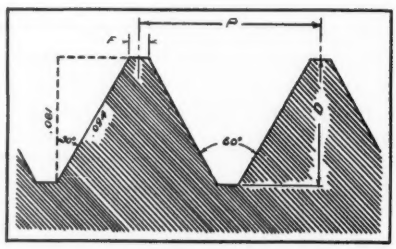
by David T. Armstrong,
EMERSON HIGH SCHOOL, UNION CITY, N. J.

THOUGHTFUL students frequently ask, "Is there any method of determining how deep the cutting tool should be fed into the work in order to cut accurate American National Standard Screw Threads on a screw cutting lathe?" The answer to this question is simple and the explanation of the answer is not difficult although it involves some elementary trigonometry.

We are dealing with a problem involving a right triangle and we are interested in knowing the length of the leg and of the hypotenuse, correct to thousandths of an inch. The length of either will suit our purpose. If we determine the length of the leg as a reference, we must feed in so many thousandths with the micrometer cross feed. If, on the other hand, we determine the length of the hypotenuse as a reference we must feed in at an angle of 30° so many thousandths with the micrometer compound rest feed.

Of the two methods, the simpler is to use the length of the leg of the triangle and feed in with the cross feed. No trigonometry is necessary to calculate the number of thousandths of an inch the cross feed must be advanced to cut an accurate National Form thread. A simple example will make this clear. The depth of any thread in this series, either coarse or fine, may be computed by multiplying the pitch by the constant .649519. The pitch of a screw is $\frac{1}{\text{number of threads per inch.}}$ Thus, if a screw having 8 threads per inch is to be cut, it will be necessary to advance the cross feed .081, which is ⅛ of .649519. If a screw having 12 threads per inch is to be cut by this method, it will be necessary to advance the cross feed 1/12 of .649519, or .054.

The second method, which is a little more difficult because it involves some elementary trigonometry, is to use the length of the hypotenuse and feed in with the compound rest. In order to calculate the length of the hypotenuse we use the length of the leg as calculated above and the cosine of the included angle which is 30°. The cosine of an angle is the ratio of the side adjacent to the angle and the hypotenuse, or, the



FORMULA

$$P = \text{Pitch} = \frac{1}{\text{No. Th'ds per In.}}$$

$$D = \text{Depth} = P \times .649519$$

$$F = \text{Flat} = \frac{P}{8}$$

cosine is $\frac{\text{side adjacent to the angle}}{\text{hypotenuse}}$. The cosine of 30° is .86603. Thus, the length of the hypotenuse of a screw thread with 8 threads to the inch will be $\frac{.081}{.866}$ or .094. This figure, which is the length of the hypotenuse of the right triangle, is the number of thousandths of an inch the micrometer compound rest must be fed into the work to produce an accurate thread with a pitch of ⅛. If we desire to cut a thread with a pitch of 1/13, it will be necessary to feed in the compound rest .057. In this instance the leg of the triangle, or the length of the side adjacent to the angle is .049. The length of the hypotenuse will be $\frac{.049}{.866}$ or .057.

An understanding of the above explanation will help us to arrive at a constant for any thread cut at an angle of 30°. The depth of any National Form thread is determined by using .649519. Since this is a constant, and since the angle 30° is a constant, the hypotenuse of the triangle will also be a constant, viz., $\frac{.649519}{.86603}$ or .750. Using .750 as a constant it is now possible to determine the number of thousandths it is necessary to feed the compound slide in to cut a thread of any given pitch. Thus, for 8 threads per inch, it is necessary to feed the compound slide in ⅛ of .750 or .094. For 10 threads per inch, it is necessary to feed in 1/10 of .750 or .075.

Some machinists like to use the cross feed for cutting threads, since, because it is necessary to feed in a fewer number of thousandths, the work can be done faster. However, on the basis of my own personal experience, better threads can be cut by feeding in with the compound slide. In this way most of the metal is removed by the left side of the tool bit and the chip curls out of the way of the work. The angle on the right side of the tool bit is 30°; this will give a smooth surface to the right side of the thread. When this method is used the final finishing cuts, i.e., the last two or three thousandths, should be taken by feeding the cutter bit straight in with the cross feed. Because there is some spring in the tool holder it is good practice to run the tool through the work twice without changing the setting on the micrometer collar just before the final finishing cut is taken.

On production work in large shops it is customary practice to set the compound rest at an angle of 29°. The method described above can be used for such problems also. Simply use the cosine of 29° in place of the cosine of 30°.

One word of caution is necessary. It is absolutely essential that the tool bit be cut to exactly 60° and that the flat point of the tool bit be as close as possible to the flat desired in the screw thread. The flat is always ⅛ of the pitch. Thus if the pitch is 8 threads to the inch, the flat is 1/64 of an inch; if the flat is 1/88 of an inch, the pitch is 11 threads to the inch.

The method described here may be applied to determine the angular depth of other standard screw thread forms by using the depth constant for that screw form and the cosine of one-half the included angle of the thread.

Nothing in this explanation should be construed as making unnecessary the use of thread gages for checking both the pitch and the pitch diameter of screw threads. As a result of reading this article the idea might occur to the inexperienced operator that it is possible to cut perfect threads by measurements alone. The only threads that will be interchangeable with threads produced by other mechanics will be those that are checked constantly by means of suitable gages.

IN THE Morning Mail...

Brief comments about SCHOOL SHOP *and the field it serves are invited. Address the Editor,* SCHOOL SHOP, *Ann Arbor, Michigan.*

Gentlemen:

I see by the April issue of SCHOOL SHOP that you are interested in what the different schools are doing to help the war effort. We here at Alton Senior High School have two woodworking shops manned by four instructors and running continuously from 7:30 A.M. to 4:10 P.M. We have about 250 boys per day. We are making table lamps, smoking stands, writing lap-boards, games, etc., for the recreational rooms of Army camps. Our department furnishes all material and our shop boys the labor. The cost is met by the Junior Red Cross.

The job of constructing solid model planes for the Navy and civilian-defense training centers is taken care of by volunteers who wish to do their bit by building these planes during their study-hall periods and after school. The material for these planes has been donated. Any boy who wishes may construct a plane which will be sent to the government center if it passes inspection; otherwise he may keep it. A great deal of interest is manifested in plane building and our greatest problem is getting enough different kinds of plans. Working 90 minutes a day, it takes the average boy around ten days to complete his plane.

V. O. HAINLINE
Alton, Illinois

[SCHOOL SHOP will be glad to publish plans and photographs of projects suitable for Army Camps and Naval Training Stations. Send us your manuscript.—*Ed.*]

Gentlemen:

We are always on the lookout for new and attractive problems in woodwork, but we think that the Masonic birdhouse in the current issue is certainly not in that class. Wrens are very particular regarding living quarters and the author suggests red, green, and gold as attractive—we have found weathered colors, soft and natural, much better. As regards the design, well, we cannot connect a Masonic emblem with a motif for design, any more than we can imagine cutting up Old Glory for a bathing suit.

G. BUSH
FLOYD W. BLUM
Lincoln High School
Cleveland, Ohio

[Before retiring in confusion, we must pause to state that Pennsylvania wrens, the obstinate creatures, found the house habitable.—*Ed.*]

Gentlemen:

. . . Dr. Price's suggestion [see *In the Morning Mail*, SCHOOL SHOP for March, 1942.—*Ed.*] of a digest or abstract of research projects of interest to shop teachers is interesting.

This reminds me that there are in the field two publications summarizing the latest developments in equipment and materials available to industry, viz., *New Equipment Digest*, Thomas Publishing Co., New York, and *I. N. S.*, Industrial News Service, Chicago. These might be of interest to coordinators and others in vocational education who may not be familiar with them. We should try to keep in touch with the materials and methods of industry, whether they are directly applicable to the school situation or not.

R. G. BRADSHAW
Delphi, Ind.

Gentlemen:

Thank you for sending SCHOOL SHOP. It gives you someone else's ideas, which helps a great deal toward making a better teacher. I wish to congratulate you on the fine work you are doing.

ALFRED A. DUPAR
Vocational Coordinator
Wilmerding, Pa., Schools

Gentlemen:

. . . All of our industrial arts teachers here in Ottumwa agree with me that you are doing a wonderful piece of work. All of us have obtained a number of ideas from SCHOOL SHOP that are of immediate help to us in our work.

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Books . . .

Practical Arc Welding. Chaffee. Troy, Ohio: Hobart Brothers Company, 1942. Pp. 516. $2.00.

In five parts: part I consists of general information on the history and development of arc welding, its fundamentals and applications, the tools, materials, and symbols used in welding, and the development of welding personnel. Part II is the operator training course, containing a series of 41 exercises on arc welding together with questions and weld tests. Included also are the definitions of welding terms as set forth by the American Welding Society. Tables of useful information; index; profusely illustrated.

Instructional material in *Practical Arc Welding* has been prepared out of the experience of the Hobart Trade School at Troy in the training of arc welders.

Aircraft Sheet Metalwork. Giachino. Peoria: The Manual Arts Press, 1942. Pp. 123. $2.92 (for both parts).

In two parts, a textbook and a workbook containing blueprint job sheets in aircraft sheet metalwork. Instructional material in the text includes a study of aluminum and its alloys; measuring and laying out; bending, cutting, drilling, filing, and forming; riveting; crimping; beading; and sheetmetal development. Decimal-equivalent chart; index. The workbook is in four units: I, jobs in layout, cutting and bending; II, jobs requiring forming operations; III, jobs in riveting; and IV, jobs requiring development operations.

J. W. Giachino is instructor in the Department of Aircraft Mechanics, Western Michigan College of Education, Kalamazoo, Michigan.

How to Do Aircraft Sheetmetal Work. Norcross and Quinn. New York: McGraw-Hill Book Co., Inc., 1942. Pp. viii + 285. $2.20.

The first part of the book is devoted to the fundamentals of aircraft work: blueprint reading, shop mathematics, aircraft materials, measurement, templates, and layout. Each of the sheetmetal working processes then receives a chapter, e.g., cutting sheet; filing; forming; stamping; drilling; riveting; jig assembly; skin fitting; and welding. A chapter of shop projects is also included. Appendixes on nomenclature and tool requirements; index; illustrated.

Carl Norcross is managing editor, *Aviation* magazine; James D. Quinn, Jr., is a lieutenant in the U. S. Naval Reserve and officer in charge of the ground school, U. S. Naval Air Station, New York.

Youth Must Fly. McDonald. New York: Harper & Brothers, 1942. Pp. xi + 221. $2.50.

In *Youth Must Fly,* Commander McDonald presents the case for the training of glider pilots in the schools of the nation. Gliding is discussed both as a sport in itself, and as preliminary training for the piloting of power planes. Although the war adds urgency to the glider program, the book concerns itself equally with the peacetime possibilities of this relatively new sport.

Lt. Com. E. F. McDonald, Jr., U.S.N.R., is president of Zenith Radio Corp. and for many years has been a glider enthusiast.

Inspection Practice. Albany: New York State Education Department, 1941. Pp. 107.

Suggestions for Organizing and Operating a Laboratory Course in Inspection Practice is the complete title of this wire-bound, paper-covered book. The inspection course is confined to machined parts, tools, and gages, in three units. The book discusses the origin and development of the New York State courses, an overview of the courses as a whole, teacher and trainee qualifications, laboratory layout and equipment, parts for inspection, and suggestions to teachers. References; blueprint illustrations.

Books in this series should be purchased from the Greenwood Company, 49 Sheridan St., Albany, N.Y.

How to Run a Lathe. J. J. O'Brien and M. W. O'Brien. South Bend: South Bend Lathe Works, 1942. Pp. 128. $0.25.

South Bend Lathe Works has just issued the forty-first edition of its popular lathe operator's manual. Changes in text and illustration have been made to further the usefulness of the book in defense training. The book covers all phases of lathe operation as well as tool grinding, measurements, and has complete reference tables.

Copies are available from South Bend Lathe Works, Department S5, South Bend, Ind.

Blueprint Reading. Dick. New York: The Ronald Press Company, 1942. Pp. xiv + 157. $2.40.

The first part covers the information basic to blueprint reading, as well as abbreviations and symbols used in blueprints. The second section contains 52 assignments and about as many sketching problems. Index.

Arthur A. Dick, B.S., M.A., is chairman of the industrial arts department, Sparrows Point High School, Baltimore County, Md.

Practical Aircraft Sheetmetal Work. Frazer and Berthiaume. New York: McGraw-Hill Book Co., Inc., 1942. Pp. xiv + 193. $3.00.

A workbook-style treatment of aircraft sheetmetal work. Part I consists of 17 projects in assembly, with necessary related information. Part II is related information on aluminum and its alloys, stainless steel, the use of these metals, and on aircraft nomenclature. Part III is on developing templates and on principles of blueprint reading. The fourth unit consists of a series of exercises in blueprint reading. Index; blueprints.

Russ Frazier is supervisor of aircraft training, Murray Corporation of America, Detroit; Orrin Berthiaume is head of the aircraft sheetmetal department, Santa Monica Technical School, Santa Monica, Calif.

Shaper and Planer Job Training Units. Chicago: American Technical Society, 1942. Pp. 115. $1.35.

A series of job units and job check sheets on shaper and planer operation. Each job lists materials, general instructions, operating steps, sketches, precautions, as well as references and questions. Additional jobs are included for shaper operation as supplementary training and for testing the trainee.

This series of machine-shop training units was prepared by members of the staff of the Dunwoody Industrial Institute, Minneapolis.

Model Plans of 20 Airplanes. New York: Ascot Press, 1942. Two books, $0.25 each postpaid.

Each book contains 20 plans for model planes of the United States, Great Britain, Germany, etc. Plans are complete with working drawings and templates, as prepared by the Bureau of Aeronautics of the Navy Department for the nationwide project on construction of models for various military and civilian defense purposes.

Machine Shop Work. Shuman. Chicago: American Technical Society, 1942. Pp. viii + 499. $3.50.

This new book on machine-shop work covers in separate chapters each of the machining methods: hand tools, drilling, turning, grinding, planing, milling, etc. Also included are chapters on threading, linear measurement, layout tools and their use. Tables; index; illustrated.

John T. Shuman is coordinator at the Williamsport, Pa., Technical Institute. Collaborating with him were Horace H. Lowell, Lewis H. Bardo and J. O. Corbin, all instructors in machine-shop practice at the Williamsport Technical Institute.

Slidefilms . . .

Aircraft Engine Mechanics Series. Detroit: The Jam Handy Organization, 1942. For sale only. $3.50 per film.

Three slidefilms on aircraft engine mechanics. The first deals with aircraft ignition and engine lubrication; the second, with the engine itself—its principles of operation and the function of the pistons, connecting rods, crankshaft, etc.; and the third with the refueling procedure, which is described step by step with safety measures emphasized.

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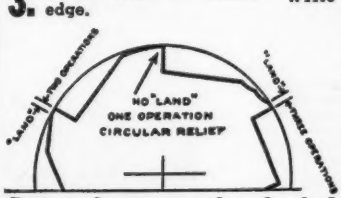

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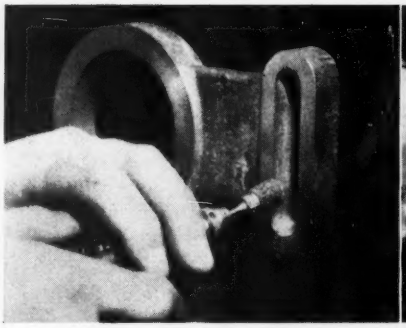
The Cover

THE young lady is learning lathe operation under the wartime training program at the Chicopee, Mass., Vocational School. This illustration as well as those on pages 6, 8, and 14 are reproduced through the courtesy of the Vocational Division, Massachusetts State Department of Education, Dr. R. O. Small, Director. The photographs on page 20 are courtesy of the Behr-Manning Corp., Troy, N. Y.



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Abrasives in War Production

BY *Robert H. Simmons*

AMERICA has become the largest fabricator and user of metals in the history of civilization. There is hardly a thing we consider necessary to our standard of living which is not either made of metal or manufactured on a metal machine. And yet, paradoxically, we find ourselves at the beginning of the present "metal war" without the skilled metalcraftsmen necessary to make our superior position effective.

This unfortunate situation did not result from the failure of any one institution or group to meet its responsibilities—rather it is our collective fault as a nation; each of us is, in a measure, somewhat responsible. The immediate significance of this weakness is that it must not have a disastrous effect upon our war effort. *This* is the responsibility of the directors and instructors of our training programs.

These men have a tremendous job which must be successfully completed in an unreasonably short time. It is made more difficult and complicated by the rapid, almost daily, technological advance of our metal-fabricating industries. Production methods, materials, even machine tools themselves, are improved and changed so rapidly that even a high-speed training program could not hope to keep pace.

Industry, too, shares this problem with the vocational schools—that of winning the war with technical developments and "know-how." The pictures on this page illustrate how one industry, the abrasives industry, is doing just that. The vital importance of micro-tolerances and finish in the machines of peace has sponsored developments of incalculable value in producing machines of war.

Already at work on the assembly line when war broke out were aluminum oxide and silicon carbide products. Aluminum oxide, especially, had demonstrated its superiority to emery cloth as a cutting and finishing agent long before the war began. (The table at the end of this article compares grit numbers of aluminum oxide and emery cloth as you would use them in your shop.)

These pictures have their counterparts in your shop, where today training must be quick, accurate, and thorough. Just as the most modern, efficient tool must be used in industry, so must it become a part of the training of the mechanic for industry.

	Coarse	Medium	Fine	Very Fine
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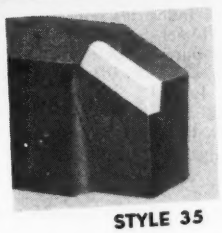
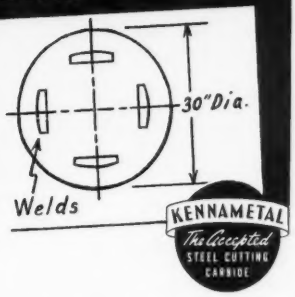
Emery Cloth	2½	1	0	3/0
Crocus Cloth	One grit only			Superfine

GLASS HARD WELD SPOTS
Machined at 376 surface ft./min. with KENNAMETAL TOOLS





STYLE 35

Here is an outstanding example of the versatility of KENNAMETAL. Four lugs had been welded to the face of a large SAE 4160 steel casting, heat treated to 375-400 Brinell, in order to chuck it while facing one side and turning O.D. The lugs were then knocked off, leaving glass hard weld spots to be removed in the facing operation.

A 1½" square KENNAMETAL tool (Grade KM), with 35° neg. back rake and 15° pos. side rake successfully faced this work at 376 surface ft./min., with depth of cut of 1/16" and feed of 1/64". Two complete pieces were finished per tool grind.

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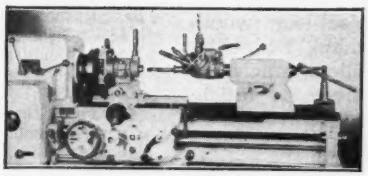
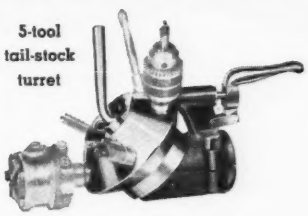


Photo shows turrets applied to 16" lathe

Train TURRET LATHE Operators on your ENGINE LATHE



5-tool tail-stock turret

● This new modern TOOL-POST TURRET (below, right), made in 2 sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard tool holders which are easily inserted and rigidly held. *10 days delivery.*

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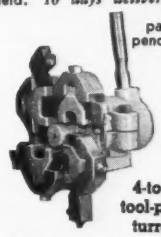

4-tool tool-post turret

● Then there's the completely modernized 5-tool TAIL-STOCK TURRET (above), made in 4 sizes to fit small bench lathes and lathes up to 20" swing. Also the adjustable PULL-FEED LEVER. All tools are precision made attachments which will convert any engine lathe into a production turret lathe. *10 days delivery.*

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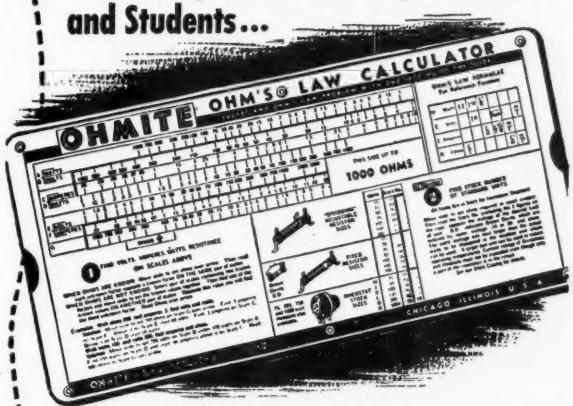

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. . . news from INDUSTRY

For items listed in this column, readers may address the firm named or write to News from Industry Dept., SCHOOL SHOP, Box 100, Ann Arbor, Michigan.

New Arc Welding Film by General Electric

"The Inside of Arc Welding" is a new film recently released for showing in vocational schools and classes by General Electric Company, Schenectady, N. Y. First reel of the six-part, all-color, 16 mm. sound motion picture is now ready for distribution.

Features of the film are close-ups of expert operators in action, the arc itself, and the animated-cartoon story of Joe Magee who contributes to the instructional value of the film by emphasizing in a humorous way the experiences of the learning welder.

The first film shows the fundamentals of welding—how good welds are made and how the four important factors of current setting, angle of electrode, arc length, and speed of travel, are controlled.

The new film is available on a loan basis or may be purchased at print cost. Inquiries should be addressed to SCHOOL SHOP or to the General Electric Company, Visual Instruction Section, Schenectady, N. Y.

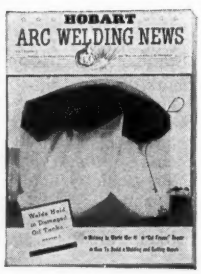
DeVilbiss Prepares Booklet on Spray Painting Equipment

A handbook, *The A B C of Spray Painting Equipment*, has been published by the DeVilbiss Company, Toledo, Ohio, makers of spray painting equipment. All types of spray painting equipment are described and their functions explained and illustrated. Subjects treated are: the paint spray gun, its troubles, remedies, and accessories; material containers; hose and hose connections; air transformers, compressors, and compressing outfits. Copies may be had without charge from SCHOOL SHOP or from the company.

McKenna Metals Offers 'Vest Pocket Manual'

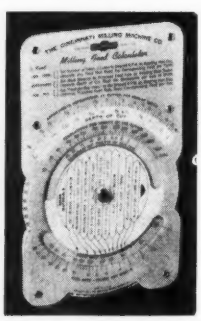
A 48-page *Kennametal Vest Pocket Manual* has just been published by McKenna Metals Co., 274 Lloyd Ave., Latrobe, Pa. Small in size, for carrying in the pocket, the new manual contains material on selecting, designing, using, brazing, and grinding *Kennametal* tools. Complete easy-to-follow instructions show the teacher and student how to get the most out of steel-cutting carbide tools. More than one hundred illustrations clarify the text. Copies may be had without charge from the company or from SCHOOL SHOP.

Hobart Publishes 'Arc Welding News'



"Arc Welding News" is the name of a new magazine for welders and welding students published by Hobart Brothers Company, Troy, Ohio. Editorial matter is made up of articles by welding experts, letters to the editor, and entries in the Hobart Arc Welding Contest. The "Arc Welding News" will be sent without charge to anyone requesting it, either directly from the company or through SCHOOL SHOP.

Cincinnati Milling Machine Offers Speed-Feed Calculator



To aid the milling machine operator in selecting the most efficient feed and speed quickly, Cincinnati Milling Machine Co., Cincinnati, Ohio, has offered its new Milling Calculator. This calculator, made of attractive plastic, will indicate the proper speed or feed by setting the several dials to correspond with the material, cutting operation, and horsepower employed. Accompanying each calculator is an instruction booklet which explains its use. A charge of fifty cents is made for this calculator, which may be ordered through SCHOOL SHOP or from the company.

Continental Publishes 'DoAll' Guide Book

A new guidebook for DoAll operators has just been published by Continental Machines, Inc., Minneapolis, Minn. This "Chalk Talk on 40 Different Ways to Cut Machining Costs" contains 48 pages of illustrations showing ways in which DoAll operators have saved themselves time and produced more work on their machines. Illustrations explain such operations as how to stack parts in making "stampings" without dies, welding the saw band, how to grind and readjust saw guide inserts, speeding up template production, and drafting symbols for sawing and filing operations.

Copies of the book may be had without charge by writing the company or SCHOOL SHOP.

Cleveland Company Markets New Indexing Head

The Cleveland Tool and Engineering Company, of Cleveland, Ohio, has just perfected its Universal Precision Indexing Head for use on milling machines, tool and surface grinders, and other machine tools. Special feature of the head is a vernier lever which will rotate the collet between index points without changing index or location of tool in the collet. The head comes equipped with a standard Hardinge collet, and is easily fitted with a straight or taper shank or three-jaw universal chuck.

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FROM

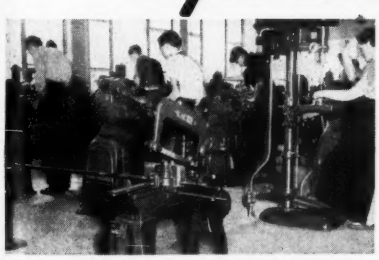
Vocational Training to Industry

WITH

Washburn Trade School — Chicago

RACINE Heavy Duty Hydraulic Saws at Defense Work somewhere in the U.S.

RACINE *Hydraulic* Power Saws



Racine Dry-Cut Utility Saw No. D-3-B—6 x 6 capacity, is a hydraulic all-purpose metal cutting machine. It is shown operating at the modern vocational training school at West Allis, Wisconsin.

It is important that shop courses include training in the operation and instruction of sawing equipment. Cut off saws perform the first operation in metalworking by sawing steel and alloy bars, tubes, structural shapes and die blocks to lengths ready for machining.

RACINE hydraulic utility saws, 6 x 6 capacity, are general all-around shop saws. They are used as tool room and maintenance saws, as auxiliary equipment in large cut off departments, and for general cutting everywhere in industry. In national defense they are found on the navy's big ships and aircraft carriers, in arsenals and air bases, at ship yards, wherever metal shops are located.

This general popularity has led to their wide acceptance among vocational schools. Here they are used for shop cutting and to demonstrate modern metal cutting machinery. Complete guarding of revolving parts protects inexperienced hands. Their oil-cushion operation and simple fool-proof construction will protect your blades and insure many years of dependable service.

Write for information today on these moderately priced saws. If you are engaged in national defense training your defense priority rating will assure reasonable delivery.

Racine Tool & Machine Co., 1754 Prospect St., RACINE, WIS., U. S. A.

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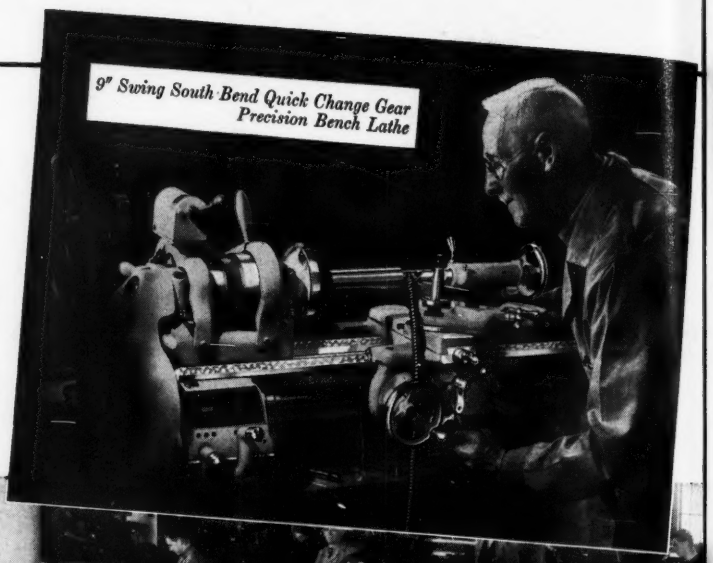
FOR INDUSTRIAL AND SCHOOL SHOPS



9" Swing South Bend Quick Change Gear Precision Bench Lathe

Sommerville (Mass.) Vocational School, equipped with 20 South Bend Motor Driven Lathes

MOTION PICTURE ON LATHE WORK

A series of 16 mm sound motion pictures adapted from the book "How to Run a Lathe" have been produced by the South Bend Lathe Works.

Professionally filmed in full color, these pictures clearly show the functions of the various lathe parts, and the performance of primary lathe operations. They will help the beginner to quickly grasp fundamental principles underlying the operation of a back-geared screw cutting lathe.

Showing time for two reels of 800 feet each is approximately 40 minutes. Write for circular telling how you can get these new films.

• In America's metal working industries, South Bend Lathes are the first choice for precision, speed and versatility.

In thousands of schools and colleges South Bend Lathes are also the first choice because there, as in industry, a machine tool must have the precision for fine workmanship and be capable of handling every job efficiently.

South Bend Lathes are made in 5 sizes: 9", 10", 13", 14½" and 16" swing, with a wide range of practical attachments. Write for catalog and the name of your nearest dealer.

SOUTH BEND LATHE WORKS

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Lathe Builders For 35 Years

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